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Does the Movement Assessment Battery for Children-2 at 3 years of age predict developmental coordination disorder at 4.5 years of age in children born very preterm?

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ABSTRACT

Background: Very preterm children (VPT) are at high risk for developmental coordination disorder (DCD). The Movement Assessment Battery for Children-2 (MABC-2) Test is commonly used to identify children with DCD, but little is known about the predictive validity of this assessment in this population.
Aims: The aims of this study were to determine if MABC-2 scores at 3 years can predict DCD at 4.5 years and if DCD can be reliably identified in VPT children at 3 years.
Methods and procedures: In a retrospective sample of 165 VPT children, logistic regression was used to determine if the MABC-2 score at 3 years is predictive of DCD at 4.5 years. Cross-tabulations were used to determine the relationship between scores at 3 years and DCD at 4.5 years.
Outcomes and results: MABC-2 scores at age 3 were a significant predictor (OR = 0.82, $p = 0.001$) of DCD diagnosis at 4.5 years. The MABC-2 has excellent sensitivity (90%), moderate specificity (69%), small to moderate positive predictive value (38%) and high negative predictive value (97%).
Conclusions and implications: The MABC-2 is highly sensitive in identifying VPT children with DCD, but also has many false positives. MABC-2 scores can reliably predict VPT children who are not at risk of DCD.

What this paper adds?

This paper adds to the research literature examining the use of the Movement Assessment Battery for Children-2 (MABC-2) Test in identifying DCD in early childhood. This is the first study to assess the predictive validity of the MABC-2 in the very preterm population at age 3 years. This study shows that the MABC-2 is highly sensitive but not very specific. A high negative predictive value shows that the MABC-2 is excellent at predicting which VPT children at 3 years are not at risk of DCD. This study also contributes to the limited literature on using the MABC-2 for early identification of DCD in a high-risk population.

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1. Introduction

Developmental coordination disorder (DCD) is an impairment in coordinated motor skills that significantly interferes with a child's performance in their everyday activities, such as self-care, school tasks, leisure activities, prevocational and vocational activities, and play (American Psychiatric Association, 2013). Difficulties with coordination and learning motor skills characteristic of DCD are present in early childhood and are not better explained by a neurological condition, intellectual disability, or visual impairment (American Psychiatric Association, 2013). While DCD may manifest in the early developmental period, the condition is often not identified until school-age (Missiuna, Moll, King, King, & Law, 2007). Children with DCD have poorer academic outcomes and may participate in fewer group activities than their typically developing peers (Cantell, Smyth, & Ahonen, 2003). As such, they are at risk for lower quality of life than their peers in physical, psychological and social functioning domains (Zwicker, Harris, & Klassen, 2013). These negative effects arising from DCD extend beyond childhood and into adulthood (Cousins & Smyth, 2003).

The prevalence of DCD in children aged 5–11 years is estimated at 5–6% (American Psychiatric Association, 2013), equating to approximately 450,000 Canadian children (Statistics Canada, 2017) and over 1,400,000 American children being affected (U.S. Census Bureau, 2010); however, children born very preterm (VPT: ≤32 weeks of gestational age) are at six to eight times higher risk for the disorder (Edwards et al., 2011). Studies have shown that 30–42% of VPT children are affected by DCD (Edwards et al., 2011; Foulder-Hughes & Cooke, 2003; Goyen & Lui, 2009). Zhu, Olsen, and Oleson (2012) showed that each week prior to 39 weeks gestation was associated with increased risk for DCD. In addition to lower gestational age, other perinatal variables that are associated with DCD include male sex, low birth weight, prolonged rupture of membranes, retinopathy of prematurity, and postnatal steroid exposure (Davis, Ford, Anderson, & Doyle, 2007; Goyen & Lui, 2009; Zhu et al., 2012; Zwicker, Yoon et al., 2013). VPT children score significantly lower on motor tests than their typically developing or full-term peers and are found to experience motor deficits in coordination, balance skills, ball skills, gross and fine motor control, and visual motor integration (De Kieviet, Piek, Aarnoudse-Noens, & Oosterlaan, 2009).

The Movement Assessment Battery for Children, 2nd edition (MABC-2) Test is the most commonly used and recommended assessment to identify children with DCD (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012); this standardized motor assessment provides information to support diagnostic criterion A by determining if the acquisition and execution of coordinated motor skills is substantially below that expected given the individual's chronological age (American Psychiatric Association, 2013; Harris, Mickelson, & Zwicker, 2015). Scores from the MABC-2 indicate if a child falls within the normal range for his age, if the child is "at risk" of having motor difficulties, or if the child has significant movement impairments. The age limit has been lowered from 4 years of age in the original version of the MABC to 3 years of age in the MABC-2 (Henderson, Sugden, & Barnett, 2007). With this lowered age limit, there now lies the possibility of using the MABC-2 to identify children who are at risk of DCD at an earlier age.

Several studies have confirmed that the MABC-2 is a reliable and valid tool to assess for movement disorders in the first age band (ages 3–6 years) (Henderson et al., 2007; Ellinoudis et al., 2011). Smits-Engelsman, Niemeijer, and van Waelvelde (2011) confirmed that the MABC-2 has good to excellent test-retest reliability in typically developing three-year-old children. However, there is limited information about the predictive validity of the MABC-2 in the VPT population in this age group. Earlier identification of DCD can allow for VPT children who are at high risk for DCD to receive appropriate interventions earlier to support their daily occupations and reduce the consequences of DCD on quality of life.

The aims of this study were to assess if the MABC-2 Test at 3 years of age can predict DCD at 4.5 years of age in VPT children and to determine if DCD can be reliably identified at age 3 with this measure in this high-risk population. We hypothesized that MABC-2 scores at age 3 years will be predictive of DCD in VPT populations and that the MABC-2 has moderate specificity and sensitivity to identify DCD at 4.5 years.

2. Material and methods

2.1. Participants

Very preterm children born at 24–32 weeks gestational age and seen in the Neonatal Follow-Up Program (NFUP) at the BC Women's Hospital in Vancouver, Canada at their 3-year and 4.5-year follow-up visits between January 2010 and July 2015 were eligible to participate in this study (n = 280). In the NFUP, children are assessed by a multidisciplinary team, including a neonatologist or developmental pediatrician, nurse, physical or occupational therapist, speech language pathologist, and psychologist. The recruitment criteria for the NFUP include birthweight ≤800 g, gestational age ≤25 completed weeks, grade 4 intraventricular hemorrhage, cystic periventricular leukomalacia, severe retinopathy of prematurity (≥stage 3 or requiring laser treatment), home oxygen therapy, and/or participants in funded research studies.

Children were excluded if: (1) they had a medical diagnosis that would impact their performance on the MABC-2 and/or preclude a diagnosis of DCD (e.g., cerebral palsy, global developmental delay, intellectual impairment, or significant visual or hearing impairments); (2) the MABC-2 was not administered at age 3 years or age 4.5 years; or (3) the child refused to complete the MABC-2. This study was approved by the University of British Columbia and Children's and Women's Health Centre of British Columbia Research Ethics Board. Parents or legal guardians of participants provided written informed consent to the use of NFUP data for research purposes.